

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions, and listings, of claims in the application.

1. (Currently Amended) An apparatus for controlling a power converter in which an output voltage is controlled by pulse-width-modulation control, the apparatus comprising:

a voltage-vector control unit that determines, based on a voltage instruction value for the power converter, voltage vectors output from the power converter in one control cycle of the pulse-width-modulation control and durations of outputting of the voltage vectors;

a voltage-vector adjusting unit that adjusts the duration of outputting of the voltage vectors ~~based on a comparison of the duration of outputting of the voltage vectors with a duration longer than zero so that the duration of outputting a zero-voltage vector is either longer than a fixed time greater than zero or is zero~~; and

a firing-pulse generating unit that generates a signal, for turning on and off semiconductor switching elements included in the power converter, based on the durations of outputting of the voltage vectors as adjusted by the voltage-vector adjusting unit.

2. (Previously Presented) The apparatus according to claim 1, wherein the voltage-vector adjusting unit adjusts the durations of outputting of the voltage vectors so that

when the duration of outputting of the zero-voltage vector is longer than a predetermined time, the duration of outputting the zero-voltage vector is ensured for at least for the fixed time, and

when the duration of outputting of the zero-voltage vector is shorter than the predetermined time, the duration of outputting of the zero-voltage vector becomes zero.

3. (Previously Presented) The apparatus according to claim 1, wherein, when the voltage-vector control unit determines the voltage vectors in more than one control cycle of the pulse-width-modulation control as a unit, if a total of the durations of outputting of the zero-voltage vector in more than one control cycle is shorter than a predetermined time, the voltage-vector adjusting unit adjusts the duration of outputting of the voltage vector so that

duration of outputting of the zero-voltage vector between two adjacent cycles becomes zero, and

duration of outputting of the zero-voltage vector between the two adjacent cycles is distributed to a duration of outputting of the zero-voltage vector in control cycles previous and next to the two adjacent cycles.

4. (Previously Presented) The apparatus according to claim 1, wherein, when the voltage-vector control unit determines the voltage vectors output from the power converter in more than one control cycle of the pulse-width-modulation control as a unit, if a total of the durations of outputting of the zero-voltage vector in more than one control cycle is shorter than a predetermined time, the voltage vector adjusting unit adjusts the durations of outputting of the voltage vectors so that durations of outputting identical voltage vectors in more than one control cycle are grouped into one.

5. (Currently Amended) The apparatus according to claim 1, further comprising:
a delay unit that delays the voltage vectors output from the voltage-vector adjusting unit by the one control cycle, and outputs the voltage vectors to the voltage-vector adjusting unit, wherein, when the time of outputting of the zero-voltage vector is shorter than a predetermined value, upon receiving a voltage vector used for an adjustment in a previous control cycle, the voltage-vector adjusting unit adjusts the time of outputting of the voltage vector based on whether a vector lastly output in the previous cycle is a zero-voltage vector, so that

one of durations of outputting of ~~a~~ the zero-voltage vector at a current cycle becomes zero, and

an amount of the one of the durations of outputting of the zero-voltage vector is distributed to another of the durations of outputting the zero-voltage vector.

6. (Previously Presented) The apparatus according to claim 1, further comprising a delay unit that delays the voltage vectors output from the voltage-vector adjusting unit by one control cycle, and outputs the voltage vectors to the voltage-vector adjusting unit, wherein, upon receiving a voltage vector used for an adjustment in a previous control cycle and duration of outputting of the voltage vectors, when a total of a first duration of outputting of a zero-voltage vector lastly adjusted in the previous cycle and a second duration of outputting of a zero-voltage vector firstly in a current cycle is shorter than a predetermined time, the voltage vector adjusting unit adjusts the duration of outputting of the voltage vectors so that the second duration becomes a duration obtained by subtracting the first duration from the predetermined time.

7. (Currently Amended) The apparatus according to claim 1, further comprising:
a delay unit that delays the voltage vectors output from the voltage-vector adjusting unit by one control cycle, and outputs the voltage vectors to the voltage-vector adjusting unit, wherein

the voltage-vector adjusting unit calculates an error accompanied by an adjustment of the durations of outputting of the voltage vectors, and adjusts the durations of outputting of the voltage vectors by correcting the voltage vectors in a current cycle with the error calculated in a previous cycle,

when a duration of outputting of ~~a~~ the zero-voltage vector is longer than a predetermined time, the duration of outputting of the zero-voltage vector is ensured at least for the fixed time, and

when the duration of outputting of the zero-voltage vector is shorter than the predetermined time, the duration of outputting of the zero-voltage vector becomes zero.

8. (Previously Presented) The apparatus according to claim 1, wherein the voltage-vector adjusting unit adjusts the durations of outputting of the voltage vectors so that the duration of outputting of the zero-voltage vector is ensured for at least the fixed time.

9. (Previously Presented) The apparatus according to claim 1, wherein the voltage-vector adjusting unit adjusts durations of outputting of the voltage vectors so that the duration of outputting of the zero-voltage vector is ensured at least for the fixed time without changing relative ratio of output durations of the voltage vectors, other than the zero-voltage vector.

Claim 10 (Cancelled).

11. (Previously Presented) The apparatus according to claim 1, wherein, when the duration of outputting of the zero-voltage vector is set to zero, the voltage-vector adjusting unit adjusts the durations of outputting of the voltage vectors so that durations of outputting the voltage vectors other than the zero-voltage vector also become either longer than the fixed time or become zero.

Claims 12-14 (Cancelled).

15. (Previously Presented) The apparatus according to claim 1, wherein, when setting the duration of outputting of the zero-voltage vector to zero, if the voltage vector lastly output in the previous cycle is different from the voltage vector firstly output in the current cycle, the voltage-vector adjusting unit replaces the voltage vector firstly output in the current cycle with the voltage vector lastly output in the previous cycle.

Claims 16-19 (Cancelled).